is, it is well known, a function homogeneous in regard to the coefficients of each equation separately, viz. of the degree n in regard to the coefficients $(a, b, \ldots)$ of the first equation, and of the degree m in regard to the coefficients $(p, q, \ldots)$ of the second equation; and it is natural to develope the resultant in the form $k\mathrm{AP}+k'\mathrm{A}'\mathrm{P}'+$ &c., where A, A′, &c. are the combinations (powers and products) of the degree n in the coefficients $(a, b, \ldots)$, P, P′, &c. are the combinations of the degree m in the coefficients $(p, q, \ldots)$, and k, k', &c. are mere numerical coefficients. The object of the present memoir is to show how this may be conveniently effected, either by the method of symmetric functions, or from the known expression of the resultant in the form of a determinant, and to exhibit the developed expressions for the resultant of two equations, the degrees of which do not exceed 4. With respect to the first method, the formula in its best form, or nearly so, is given in the 'Algebra' of Meyer Hirsch, and the application of it is very easy when the necessary tables are calculated: as to this, see my "Memoir on the Symmetric Functions of the Roots of an Equation." But when the expression for the resultant of two equations is to be calculated without the assistance of such tables, it is, I think, by far the most simple process to develope the determinant according to the second of the two methods.

V. "Memoir on the Symmetric Functions of the Roots of an Equation." By Arthur Cayley, Esq., F.R.S. Received December 18, 1856.

(Abstract.)

There are contained in a work, which is not, I think, so generally known as it deserves to be, the 'Algebra' of Meyer Hirsch, some very useful tables of the symmetric functions up to the tenth degree of the roots of an equation of any order. It seems desirable to join to these a set of tables, giving reciprocally the expressions of the powers and products of the coefficients in terms of the symmetric functions of the roots. The present memoir contains the two sets of tables, viz. the new tables distinguished by the letter (a), and the tables of Meyer Hirsch distinguished by the letter (b); the memoir contains

also some remarks as to the mode of calculation of the new tables, and also as to a peculiar symmetry of the numbers in the tables of each set, a symmetry which, so far as I am aware, has not hitherto been observed, and the existence of which appears to constitute an important theorem in the subject. The theorem in question might, I think, be deduced from a very elegant formula of M. Borchardt (referred to in the sequel), which gives the generating function of any symmetric function of the roots, and contains potentially a method for the calculation of the tables (b), but which, from the example I have given, would not appear to be a very convenient one for actual calculation.

VI. "Memoir on the Conditions for the Existence of given Systems of Equalities among the Roots of an Equation." By Arthur Cayley, Esq., F.R.S. Received December 18, 1856.

(Abstract.)

It is well known that there is a symmetric function of the roots of an equation, viz. the product of the squares of the differences of the roots, which vanishes when any two roots are put equal to each other, and that consequently such function expressed in terms of the coefficients and equated to zero, gives the condition for the existence of a pair of equal roots. And it was remarked long ago by Professor Sylvester, in some of his earlier papers in the 'Philosophical Magazine,' that the like method could be applied to finding the conditions for the existence of other systems of equalities among the roots, viz. that it was possible to form symmetric functions, each of them a sum of terms containing the product of a certain number of the differences of the roots, and such that the entire function might vanish for the particular system of equalities in question; and that such functions expressed in terms of the coefficients and equated to zero would give the required conditions. The object of the present memoir is to extend this theory, and render it exhaustive by showing how to form a series of types of all the different functions which vanish for one or more systems of equalities among the roots; and in particular to obtain by the method distinctive conditions for all the different